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THE SEASONS.

"KNOWLEDGE NEVER LEARNED OF SCHOOLS."

Edited by MISS ARMITT.

DIATOMS.

BY MRS. DORMAN.

IT may seem a trite saying that by the invention of the microscope, worlds not only unrealized but even unimagined before, have been brought within our view, and yet one cannot look into a drop of pond or bog water, teeming as it is with vegetable life in its minutest developments, without being impressed by something akin to awe, so great are the variety and beauty of the forms that are revealed by the magic glass. Through that glass we see, darkly indeed, but yet unmistakably, how the same creative energy that framed the universe, has delighted to expend itself in bringing all this varied life into being, and in tracing lines of exquisite beauty upon forms that are all but invisible to the unassisted eye, so that the infinitely small seems as marvellous as the infinitely great. All these finely sculptured lines are moreover traced upon a material so fragile as to have earned for the tiny Diatoms the name of Brittleworts, and yet so indestructible that myriads of them have been preserved in a fossil state for countless ages in the so-called Diatom earths, or Tripoli powder. It is calculated that forty millions of these delicate forms are contained in one cubic inch of Bilin slate; and a marine deposit, forty feet in depth and of unknown extent, composed for the most part of the silicious skeletons of indestructible Diatoms, underlies the city of Richmond, U.S.A. We may find them in a living state in any pool, or ditch, or horse-trough, no less than in the surface layers of the deep sea, and even amongst the organic dust of the snowfield. Dr. Hooker found Diatoms discolouring the antarctic seas, and also in the lava of a volcanic mountain. There is a whitish powdery substance known in Norway and Sweden as "mountain meal," and used by the peasants to mix with flour for bread, which is composed entirely of fossil Diatoms, and great tracts both in the arctic and antarctic regions are covered with these infinitesimal relics of a former vegetation.

What then are Diatoms? To what class of the vegetable kingdom do they belong? What is their nature, and what is known of their life-history? How may they be recognized, and how distinguished from other microscopic plants, and especially from their kindred forms the Desmids, and why, when their short lives are ended, does not their memorial perish with them? To the first question the answer is that Diatoms are "unicellular plants which grow both in salt and fresh water and upon moist soil." To the second question, the Diatomaceæ used to be placed with the Algæ, that is, when they had ceased to be considered forms of *animal* life, but they are now regarded as occupying an intermediate position between animals and plants, and form an isolated group called Bacillariales or rod-like plants; we may therefore expect their characteristics to be such as to warrant this exclusive treatment. First, as to the limits of these minute plants, for we have seen that our Diatom is confined within a single cell, and we find that its cell-wall, instead of consisting of purely vegetable matter, is formed into a veritable coat of mail by a silicious or flinty deposit, perfectly transparent indeed, but at the same time hard enough for innumerable dots and lines to be fretted or engraved upon its surface, and nothwithstanding its fragility, indestructible alike by fire or acids. Under certain aspects the cell-wall may be said to answer to the shell of a bivalve, under others to a skeleton, and it is made up of two narrow symmetrical plates, or valves, which exactly fit into each other, the living plant being enclosed in the box or shell formed by the two halves. Whether the derivation of the name Diatom from *diatomos*—cut through—refers to this division of the cell-wall or to the manner of propagation by division, I am not clear. The Diatomaceæ may be at once distinguished from the Desmids, to which they bear a superficial resemblance, by their colour, as only the large Diatom—*Pinnularia viridis*—approaches in any degree to the brilliant green of the Desmids; and they are usually of a bright golden brown, as the protoplasm and chlorophyll are stained and masked by a pigment called *diatomin.*

In a drop of bog water several common species will be found, some resting, some slowly moving, for Diatoms are by no means stationary. One little voyager, shaped like a miniature boat, pushes gently along through a seemingly impenetrable mass of débris, passes it, reaches some object too difficult for him, slowly retires, returns again, again is baffled, once more returns undaunted to the charge, and, perhaps by some fortuitous change in the concourse of atoms, finds the passage he seeks for, and at last reaches a clear space in the luminous drop. Here, side by side, is a row of *Fragillaria virescens* or *Diatoma vulgare* in a ribbon-like band, and here again we find the band is broken and the tiny plants attached to each other in zigzag fashion by their corners. Now we catch sight of a detached frustule of *Gomphonema capitatum* and begin to look eagerly for the branching filaments from which it has become detached, or a wandering *Navicula* of another species than the first arrests our attention, crossing a bright space in which seem to float a dozen or more dark-green crescents of the lovely Desmid—*Closterium lunula*—and surely, now we have a specimen of *Pinnularia viridis*, the largest of British fresh water Diatoms, for it shows as a giant amongst the other species, and one can easily see the box-like form of the plant case, and the striæ lying at right angles to its long axis, while near it is another very long and slender Navicula, with a clearly-defined line down the centre, but no visible striæ; they are there, doubtless, but cannot be seen with a quarter-inch objective.

A long and rod-like Diatom, perhaps an individual of *Synedra splendens*, has a rim of finest markings along the sides, but my drawing is from an old sketch-book, and was made some years ago when I was studying Duckweeds, and before I knew anything of Diatoms, but I think I was right in naming it *Synedra ulva*, as that species is frequently found attached to some aquatic plant; and this is the last of my acquaintance with *living* Diatoms.

We will take *Pinnularia viridis* for further study, as its comparatively large size permits us to see clearly the markings on the frustules, and the structure is more easily made out than in the smaller Diatoms. If we get an individual under observation for more than a very short period, we shall find that it has a wonderful faculty for movement, both backward and forwards, and that it frequently changes its aspect, so as at one moment to have the appearance of a long oval, and the next of a rectangle with somewhat rounded corners. These two aspects are called respectively the valve, and the girdle sides. On the valve side, furrows are seen running towards the central line, but not quite reaching it; these furrows are considered to indicate thin places on the surface of the cell-wall; on the girdle side they reappear, but only as a narrow border to the cell. With careful focussing and management of light, the box-like form of the cell, one half of which fits into the other half, may be seen, and in dead specimens still more clearly. The contents of the cell have also a different aspect as seen from the valve, or girdle side. The sort of bridge in the girdle view, is said to be the central collection of protoplasm. We noticed that the cells of *Pinnularia* were mobile, but they do not swim freely, and are supposed rather to creep along the substratum by means of a delicate protoplasmic edge like a foot, which is protruded through the cleft between the valves. If a living Diatom be heated over a flame, the result is that the cell contents are destroyed, and the cell itself remains perfect, as a skeleton. In this state, the very fine markings on the cell wall are better studied than when the plant is living. The variously sculptured, dotted and ribbed surfaces of Diatoms are favourite microscopic objects on account of their beauty and delicacy.

Under a high power the striæ of *Pleurosigma* resolve themselves into hexagonal dots, and their number may be imagined from the fact that they are calculated to be 40,000 to the square inch. This is a comparatively large Diatom.

Aulacodiscus formosus is wonderful for the beauty of its skeleton, and is so minute that it only shows as a dot on the microscopic slide. The structure appears to be cellular, and there are four exquisitely-formed tubercles set like a Maltese cross. On my slide, one disc is smaller than the other, and I take it to be the second of the two halves. Diatoms multiply themselves by sub-division lengthwise. The frustules, as the shell-like cells are technically called, separate, and two plants are thus formed out of one; each half keeps one parent valve, and develops a new and smaller one on the opposite side. By this process of multiplication it is evident that these already minute organisms must get smaller by degrees, and finally reach the vanishing point! In point of fact, this condition of things does not go on indefinitely, for when a certain size is reached a different course is followed. Either the cell contents free themselves altogether from the cell wall, enlarge, and put on new valves exactly like the parent, but much larger; or two individuals unite to form what is known as an auxopore. Sometimes the two individuals become imbedded in mucilage previous to the formation of an auxopore.

BIRDS OF LAKELAND.

THE TREE-CREEPER—*CERTHIA FAMILIARIS.*

THE quiet, solemn woods of winter; away from cheerful valley pasture and open ploughed land, from cawing Rooks and aping Shepsters, from little herding birds that haunt the lanes and way-side hedge-rows; away, too, from fruit-bearing bush and sun-warmed seed-choked soil: in the shadow, where tree-boles rise columnar from fine, sparse grass, and grey lichen clothes the spread of boughs above! Then, all at once, upon the quiet, a sharp weak sound, more like the cry of little beast than the note of bird; a swift motion, straight as falling arrow, and something alights at the base of the tree trunk, and immediately scuttles, mouse-like, up it. A bird it is, not a quadruped, yet a bird so strangely fitted for its particular place in nature as to have lost some bird-like traits. It is the Tree-creeper, the one species left (broadly speaking) to Lakeland, of a large group of birds specially adapted for a pure forest life.

For little space in Nature is lost. The tree-bole shelters numerous insects that are born in the bark of it, that seek weather-shelter in it, that go to sleep there with the prospect of awaking with wings, and all these are the very nutriment of birds. So, just as the frame of one bird is sufficiently modified from the normal type for it to be able to walk submerged on the bottom of streams, and pluck off insects sticking thereon, so another is made capable of walking on an upright plane, and of picking them from upright cracks in trees.

Our Tree-creeper thus is fitted out physiologically for an existence of perpetual and perpendicular running, and his racecourse is the bole of trees. He may laugh at shrewd Robin, that sometimes wants to be in for the feast too, and flits jauntily on to straight trunk, making a feint of ease as he perches sideways upon it. For Robin's legs, accustomed to bear a weight of body superincumbent, would presently ache with such a strain of attitude. He need not trouble to chase the poacher off, and may pursue his business, secure in personal qualifications for a task too difficult for more normal rivals. To be sure, those qualifications only include two legs by which to "creep," but these are as good as some creatures' four, being set outward, and spread in splay-footed fashion to the side. Besides, he has in his tail, what is as good almost as a third leg, or at least is equal to the stick of a lame man. For the feather tips of this same tail, curved in, press upon the rough bark, and serve him as support when pausing in a pendant posture. He may rest upon his tail, quite sure (unlike the monks of old on their upturned choir-seats, that lend them slight support through long service hours) that it will never slip from under him while he naps; it is a safe wedge.

This hanging posture on the bark is so natural to the bird that it seems to be assumed from a very early stage of its life. At a time when one would suppose that it would be necessary for the immature nestling to cower upon a supporting substance, or to perch (the true avian position of repose) we find the little creeper clinging to bark, and hanging on by it, just as baby ape is said to hang on to its mother's hair. I once saw a brood of three baby-creepers suspended in a compact bunch on the straight trunk of a larch tree, just high enough to be out of reach. Though fledged, they were so young as to be perfectly helpless; and they waited there with closed eyes and rudimentary up-turned beaks (a curious sight!) for the food the parent brought from time to time. I visited them next day —it was in a forest of Braemar—and found them moved further round the trunk, but looking just the same, hooked on in close file as sightless statuettes, only waking to greet the food-giver with faint chirps. Thus claws and tail are in full use before the bill is grown to its long curved shape, or is capable of probing into cracks of bark; and the bird suspends itself before it is capable of self-support. It seems to me very likely (but this I do not know) that it sleeps habitually in this posture.

Thus, fitted out with the right implements of foot and tail and needle-like bill, how deftly does our creeper ply his trade upon the bark! "Creep," after all, is not the word to express his action. He drifts upwards and to the side with a motion light as dead-brown leaf, stirred with air. Nay, when the autumn weather is hot and insects lively, he even dances upon his rugged boards, shifting by swift little springs, now right, now left, with a crisp patter of his claws on the bark, and—will he turn, like the minuet-dancers on polished floor? No, never! it is the upward course he loves. He must run ever skyward and not earthward. Even on a wall—and our shaded, moss and fern-grown walls, as well as perpendicular rocks, tempt him sometimes—does he stick to his rule, invariably dropping on wing to bottom, to pursue his heedful way to top on foot. Thus, by his odd reversal of the habits of birds, does he verify our human parable—that if we would rise, it must be by slow and careful tread, while to fall, we drop on wings of speed. But how well now, in the open glade can we see him! His colour is like the subdued gold of sun-rays when they filter through foliage, and make tiny pale patches on rugged bark; no moth could be more beautifully spotted and striped on back and wings and sides of head than he. Then his breast is pure argent. If we catch him sideways we may see its silver smoothness, and note his curious profile. It is one of curvatures—his back is round, his beak is curved at one extremity, his tail at the other. The strongly developed muscles of leg and feet give him a high-shouldered look; and his little pointed head and beak reminds one of a Shrew-mouse.

Then his quick, sharp, squeaky cry is not unmouse-like either. It is heard generally as he changes position in food seeking; he is silent as he runs, though I have known him to cheep excitedly the while he tugs at some refractory morsel in bark. This sound is often the signal of his presence in frosty winter woods, and of the neighbourhood, in spring, of a second Creeper, with whom he is possibly about to mate.

Song, as far as my knowledge goes, he has none, or, if he has, he successfully hides it in these parts. At what point of history this mouse-like runner laid aside the bird's great gift of song, who shall say? It may be he does not wish to to make himself agreeable even to his mate. He certainly has not a sociable appearance; though, to be sure, he is not averse to a certain sort of a distant companionship, and may be met with on the outskirts of those mixed parties of Gold-crests and Long-tailed and Coal-titmice that scour the winter woods together, in a mutual protection society. But still he chums or gossips with no bird. With eye and bill severely directed to the inch of bark in front of him he looks as if, like the Miller of the song, he cares for nobody and desires nobody to care for him; and, moreover, he does not injure his character for indifference by a statement of the fact to the world at large. He is jealous of his kind, for I have seen him, at nesting-time, chase another from his tree. But how he woos, I hardly know. No doubt he is then in his quiet way, excitable and happy, like other birds, though not so indiscreet. To see a nuptial pair in May, running up and about the slender outward boughs of an ash tree, pursuing their business of food-seeking without a sign or sound of sentiment, is an astonishment, and a marked contrast of temperament to the pair of Bottle-tits in the same tree at the same time, so ecstatic as they follow each other with incessant pebbly-sounding notes of love, as to be totally oblivious of food-getting or of watchers.

Still, the Tree-creeper, reserved and taciturn as he is, mates and breeds after his kind. We may, for instance, after a pair has established itself for some time in May in one particular spot of the wood, discover the builder at work. Presumably the builder is the hen, as in almost all passerine species, though the sexes are too much alike in this species to be readily distinguished. Down she drops in silent speed from above to the narrow chink chosen for a nest-side, that lies between the great oak-trunk and the knotted sycophant ivy-trunk climbing about it. There she places and arranges her material; first a foundation of small dead twigs to fill the deep but narrow pocket behind the chink, then rough light bits with splinters of rotton wood fibre and a few feathers for lining—all characteristic tree stuff gathered from above, except the feathers.

Next, in ten days' time, when the hen has settled to her long task of sitting, we may peep in on her solitude. She sits in the chink with head and curved beak thrown up, body pressed upon the heap of eggs, and her ordinarily downward-curved tail thrown up behind like any other bird's. When we withdraw our gaze, she will come off—the strain of eye-to-eye has been too great; and, alighting on an adjacent trunk, she will scuttle up it without a sound till out of sight. Then we may see the five tiny eggs, compacted in the tiny space, white with blotches at one end.

The nest is generally in a narrow slit. I have seen it set in the gashed bark of a larch tree, where the nest-stuff—fine larch twigs, with some sheep's wool and feathers—was wedged between the bare smooth trunk and the raised bark without any visible support, unless the trickling resin glued it. I have seen it, too, in a rustic and dilapidated summer-house, where the bird entered by a chink from outside to a considerable space between the inner and outer boards. This space the bird had proceeded to fill to the required height with a mass of small twigs, and upon this mass it had placed its nest sideways, where the aperture became narrower. Perhaps, this site was a last year's one, and early resorted to, for the youngsters flew from it so early as the 23rd of May. And by the 11th of June the bird was already sitting again on five or six eggs, in a new-made nest built up to the right of the main pile of twigs, while the old nest had been on the left.

The Tree-creeper is not only a second nester under favourable circumstances, but conservative in regard to its locality. The same summer-house was resorted to the next year, when the nest unfortunately came to grief. And I have been told of a certain barnside in a place where big trees are scarce, which was returned to for several seasons, and the nest placed within the chinks of stone. The parents are perfectly silent when feeding the young; they collect and carry large beakfuls of insect food into the nest at a time.

It is a very pretty sight to see a family of young Tree-creepers at large, still feeble, but beginning to use their powers and to scatter themselves. All the little ones squeal sharply to call attention to their wants and their position, while the parents hurry up the tree trunks and back with food to supply them. One youngster, bold of wing, will follow its parent to the base of the next tree trunk, and scuttle up it too, though not so fast, and the old bird has to drop back to feed it. Another clings firmly to the bark, afraid yet to move, with all its tail feathers spread like a lady's fan, and every individual feather of its back marked round with light. It does its best, and tries to root in the bark with still short and inexperienced beak. But once beyond the parents' care, the little Tree-creepers appear to become miniature millers at once, each one engrossed solely in the feeding of its own little wheel of appetite. Again (for no migratory instinct would seem to trouble him), does the Creeper become the solitary small brown presence that haunts our quietest walks in winter. He goes on footing it hardily through bitterest frost of Christmas time (a date no doubt unknown to birds, and not generally merry for them) when skaters spin over the ice below his slope of trees. And, secure upon his upright plane, the snows that fall and clog the land, and dishearten and starve non-creeping birds, affect him not at all.

M. L. A.

NATURE NOTES FOR DECEMBER.

Whenever the last month of the year is mild and open, late survivals of the past autumn linger on to greet the early harbingers of next year's spring. Ivy, which is perhaps most truly the last flower of the year, may still bear large bosses of bloom, to be on sunny days the meeting place and feasting place of all the flies and winged creatures that are tempted by warmth out of their winter holes. Still, even ivy will have its terminal umbels gone to fruit, and it will be only the lower and smaller ones that, bearing stamens, are not yet beyond the flowering stage. Some lingering Crepis or Hieracium may yet show a yellow disc, and daisies abound in cut lawns.

In the gardens, not one or two, but many species of spring flowers may develop and open their foremost buds. In the hedgerows of some Decembers, hazel catkins may be hanging limp and open; at the very end of the month one may even, in occasional years, find the tiny bunches of little crimson tongues, that are the pistils.

Mosses begin to thrive once more in the damp, after the terrible summer they have experienced: there is an opposite to the proverb, "'Tis an ill wind," that might run, "Ne'er a sunny day but hurts someone." One may note in winter how there is nothing so barren in nature as to be without its dependents. Even the bare ash tree, whose fruit, as far as I know, no bird will eat, fosters life about it; for where it uprears itself by a dry stone wall, on which nothing but the greyest lichens and Racomitriums (woolly moss) will grow, there nourished by its drip, are thick round bosses of Dicranums and Hypnums, with topping sprays of the evergreen polypody fern.

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